HIGH TORQUE
高擎机电

高擎电机调试助手
使用说明书

HIGH TORQUE Motor Debugging Assistant

User manual

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GQJD2022

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Release notes apply

◎ This manual is applicable to the high torque debugging assistant v0.11.1 and above.
◎ The high torque debugging assistant is suitable for motor firmware in v3.1.0 and above.

1. Instructions for using the motor

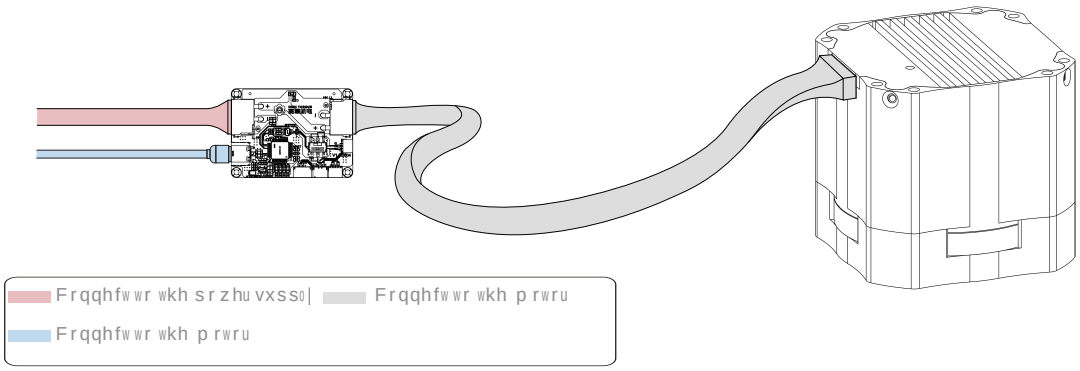
1.1 Hardware wiring of the motor

Hardware wiring of the motor 24VDC

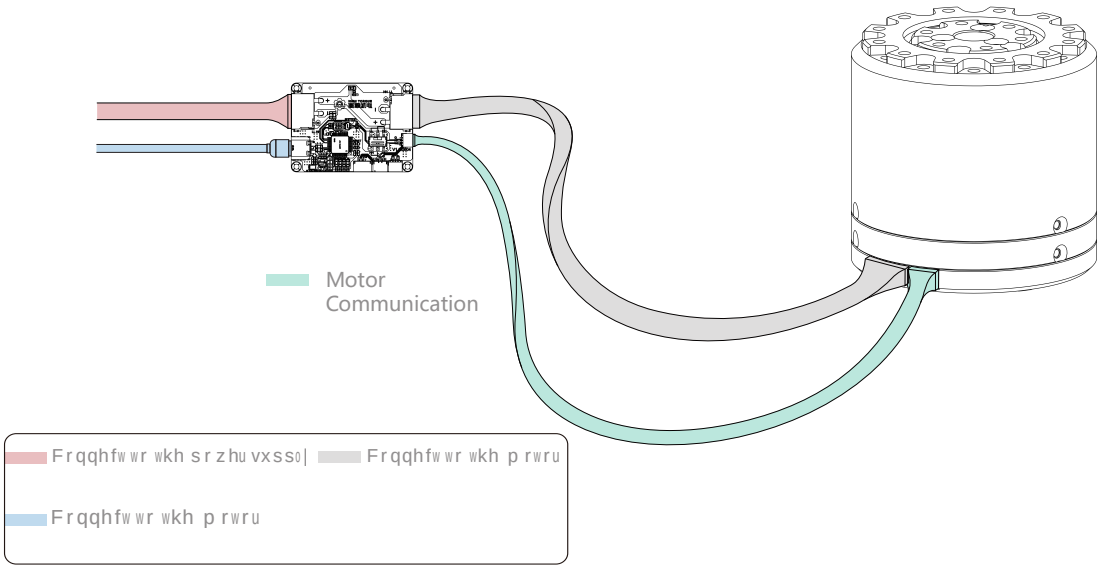
Commissioning wiring

❶ The motor XT30 (2 2) interface is connected to the FDCAN module, and the typc interface of the FDCAN module is connected to the computer.

- Motor model：5047、4438



❷ The motor XT30 interface is connected to the FDCAN module, and the FDCAN module type-c interface is connected to the computer. Use GH1.25_3P line Connect the motor and the FDCAN module,and the motor power supply is connected to the FDCAN module.



2. How to use the motor debugging assistant and instru -ctions

2.1 How to use the motor debugging assistant and instructions

❶ Basic information and functions

Scan connected USBCAN devices and detect if they are connected to the motor, If the connection is disconnected or multiple motors are not fully recognized during debugging debugging, you can click "Reconnect USBCAN device" again.

❷Output information Printing information of motor connection, motor calibration information output, etc.

❸Common features

◎ **Motor ID:** Displays the ID of the currently connected motor;

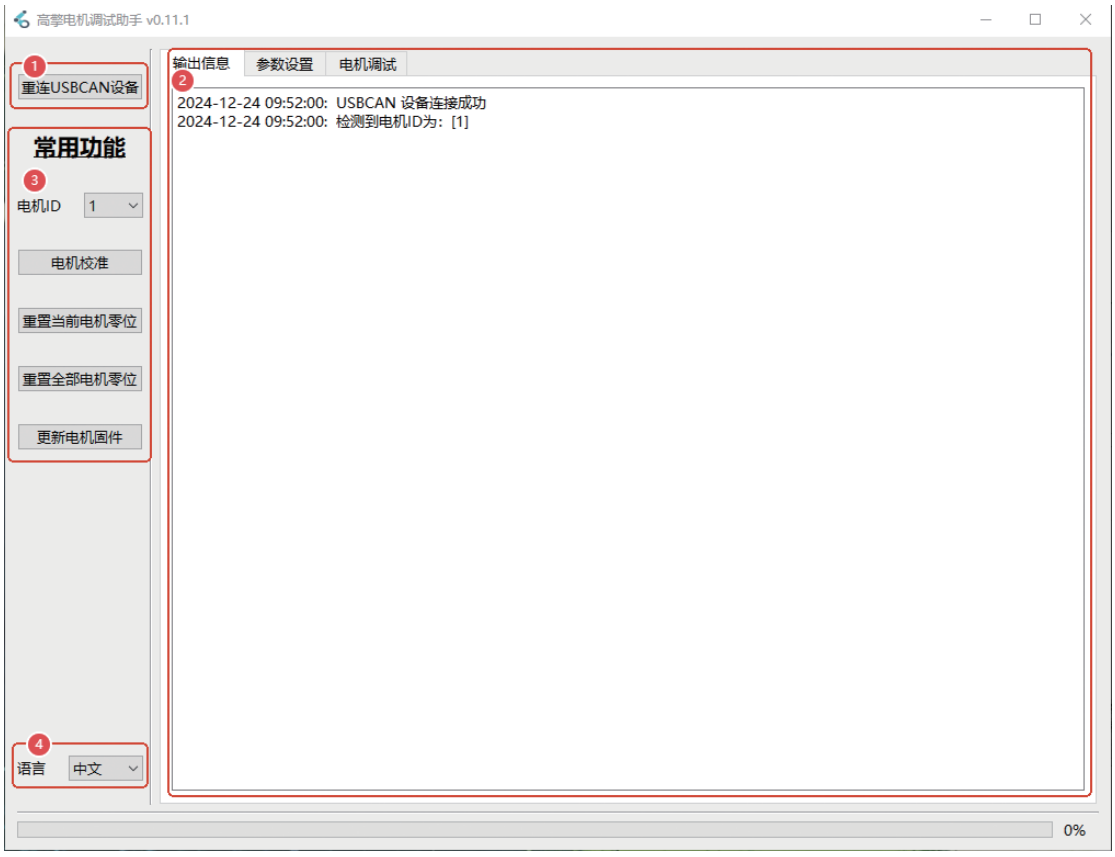
◎ **Motor calibration:** Recalibrate the motor, Do not have any load on the motor during calibration, At the same time, print the calibration process in the output information window and display the progress below;

◎ **Resets the current motor zero:** Reset the individual motor selected by the "Motor ID" to the zero position;

◎ **Reset all motor zero bit :**Reset all motors identified by the host machine to zero bit

◎ **Update the motor firmware:** The selected firmware is updated to the motor, and the information is printed out.

❹ language Support Chinese and English interfaces.



2.2 Parameter settings

Read and write parameters can read and modify the following parameters of the motor (motor protection, PID adjustment, modification motor ID, motor position range, rotation limit).

◎ **Basic information:** Display the basic information of the motor;

◎ **Motor protection:** The motor exceeds the voltage or temperature limit and stops rotating, and the parameters are written after change.

◎ **PID adjustment:** The internal PID of the motor (i_limt is the integration limit), write the parameters after change;

◎ **Modify the motor ID:** Change the motor ID, re-identify the motor, and write the parameters after the change;

◎ **Motor position range:** Control the maximum and minimum range of motor position (nan means unlimited), write parameters after change;

◎ **Rotation limit:** Set the motor speed, acceleration, and current limits (nan means unlimited), and write the parameters after changing.

2.3 Motor commissioning

❶ motor operating mode Debugging in different operating modes (see 2.4 for details).

❷ Motor status Click "Add Waveform" to display the waveform and temperature of the motor position, speed, torque and motor status (non-zero value is the motor error code, please refer to the appendix error code description table for specific reasons);

❸ Generate frames FDCAN frame information of the current operating state of the motor (optional float, int16, int32, CAN frame);

◎ **float、int16、int32:**

For specific program functions, see "CAN_H730/Src/livelybot_fdcan/live-lybot_fdcan.c in the Fdcan protocol analysis of high-powered motors" (see Chapter 3 "Analysis of Generated Frame Examples" for examples);

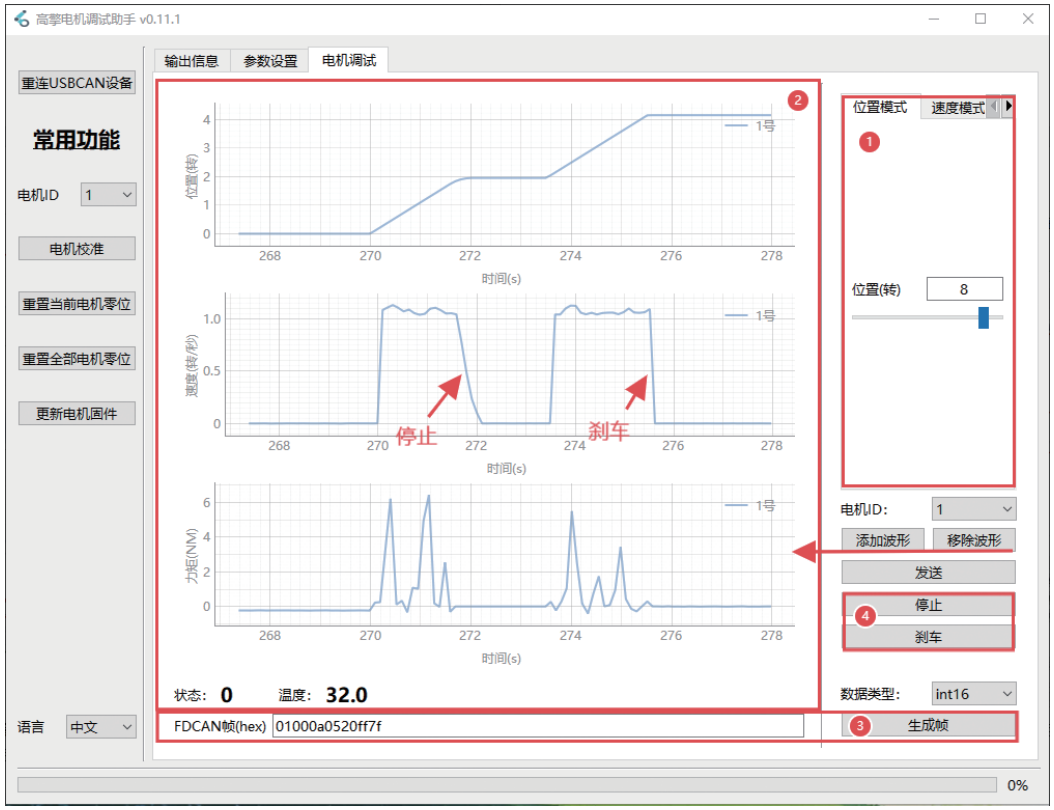
◎ **CAN frames:**

For specific program functions, please refer to "High-Engine Motor CAN Protocol Analysis/can_h730/App/Livelybot/livelybot_can.c" (the usage method is the same as above, but the information is in "High-Engine Motor CAN Protocol Analysis").

❹ Stop and brake

◎ **stop** > Stop is that all three phases are disconnected, and the motor still has a certain inertia to stop slowly after clicking to stop;

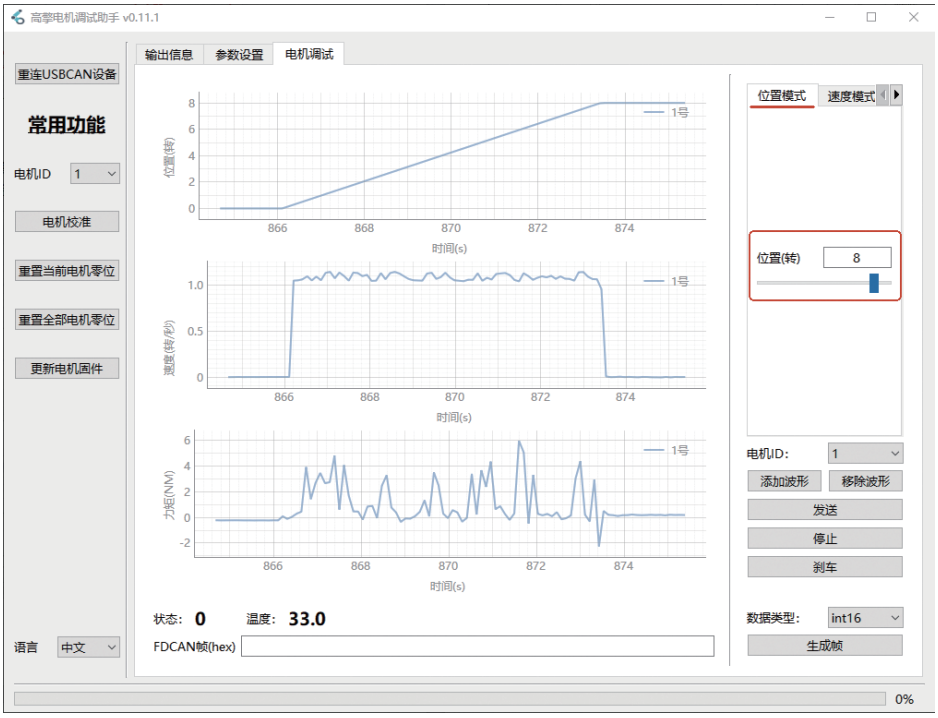
◎ **brake** > The brake is three-phase grounded, and the motor stops immediately after clicking the brake.



2.4 Motor operation mode description

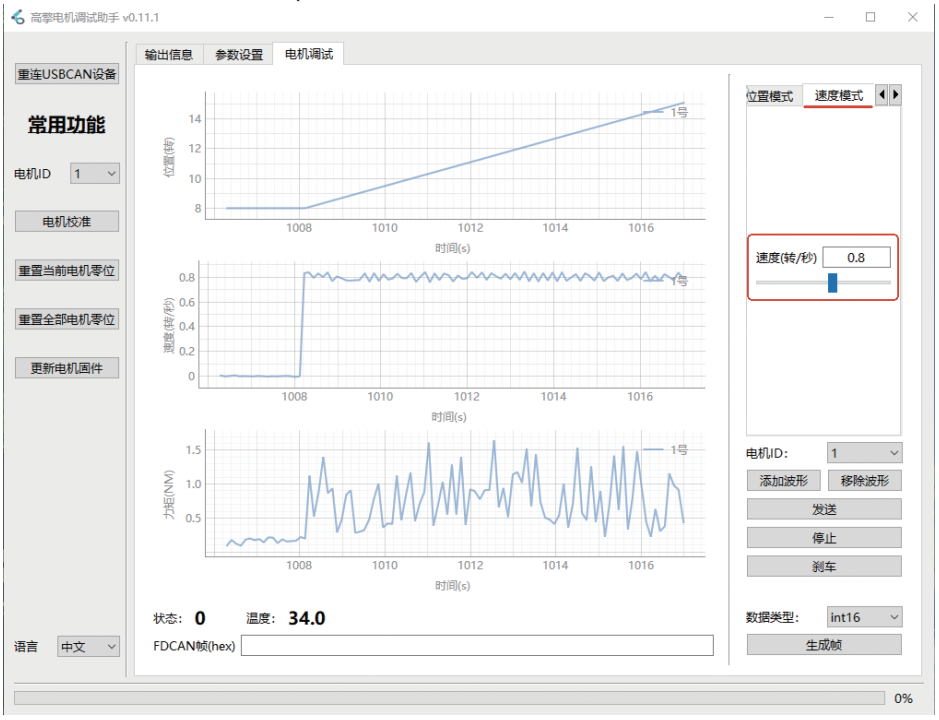
❶ Location mode

Click to send the set position, the motor rotates to the specified position with the maximum acceleration and speed, if the acceleration and speed are set in the parameter settings, then the set acceleration and speed are turned to the specified position;



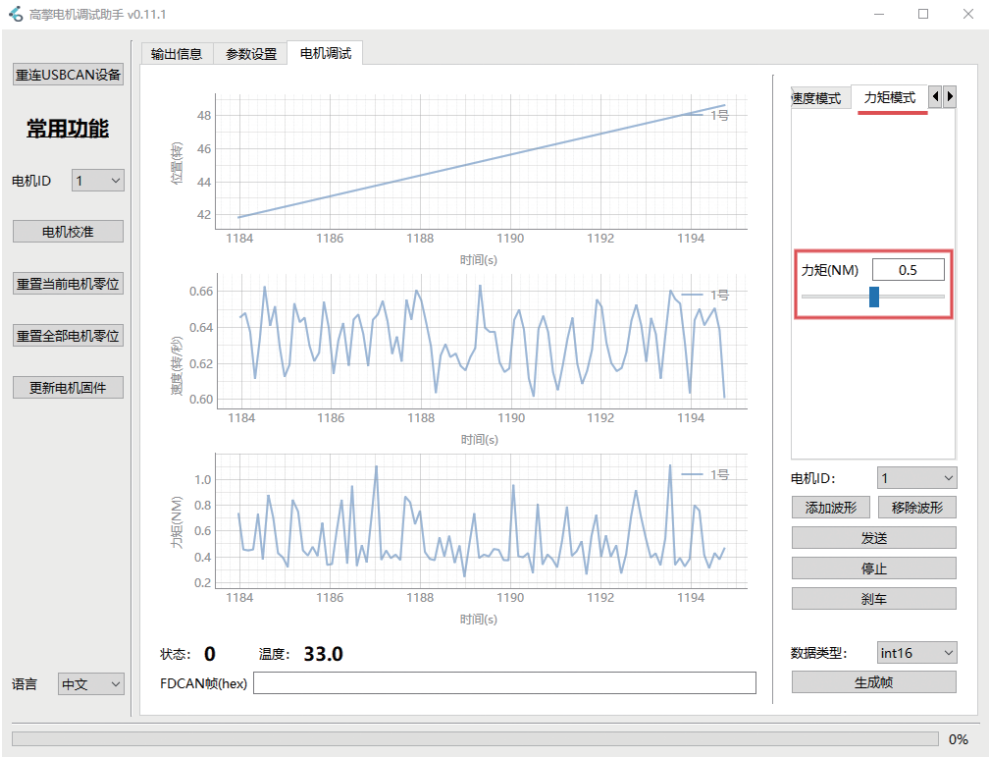
❷ Speed mode

Click to send the set speed, the motor turns to the specified speed with the maximum acceleration, if the acceleration limit is set in the parameter setting, it rotates to the specified speed with the set acceleration;



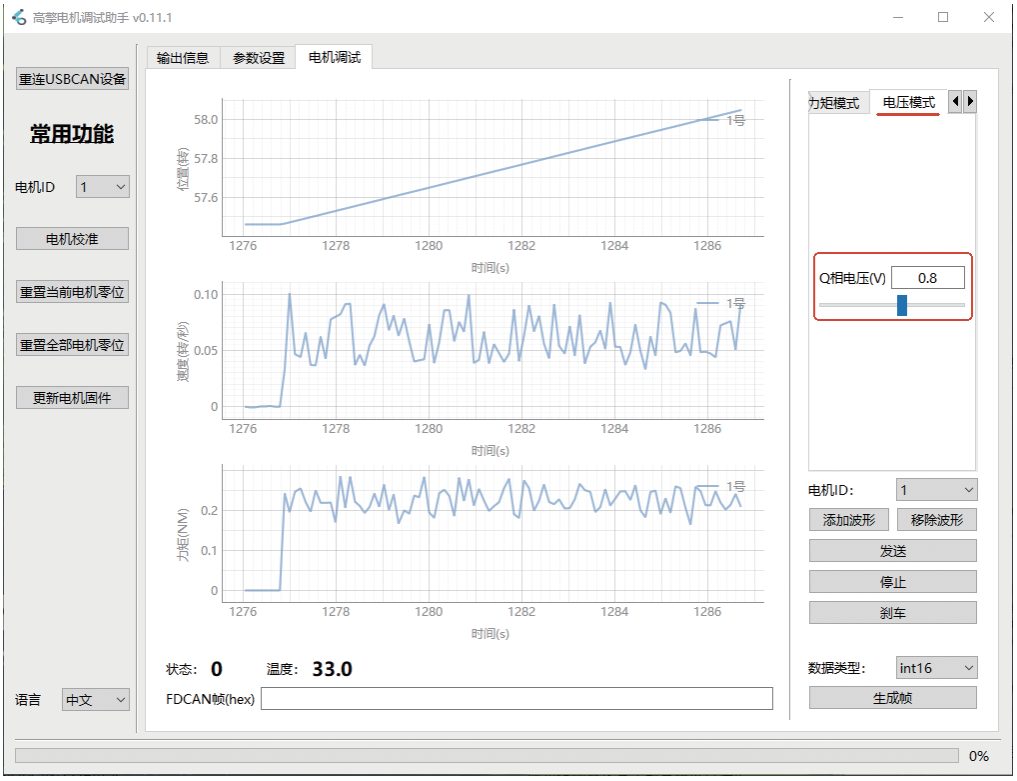
❸ Moment mode

The set torque is clicked to send, and the motor outputs according to the specified torque, if the external resistance is greater than the set torque, the motor will be blocked;



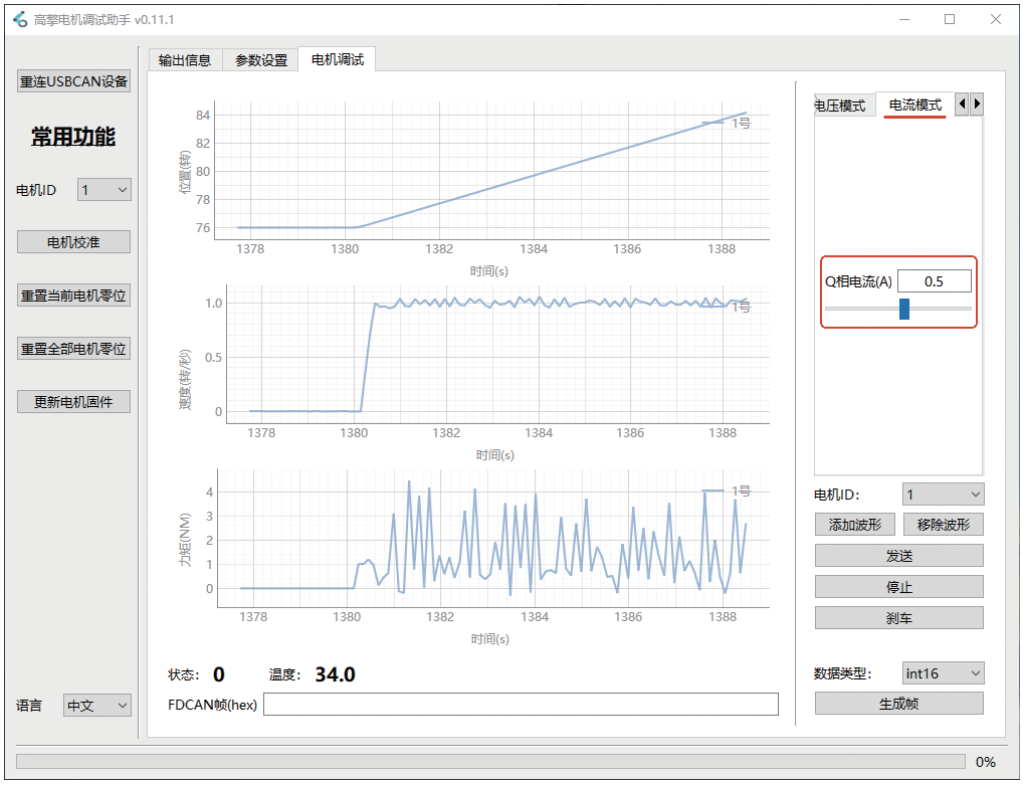
❹ Voltage mode

Set the Q phase voltage to send, given the specified Q phase voltage of the motor;



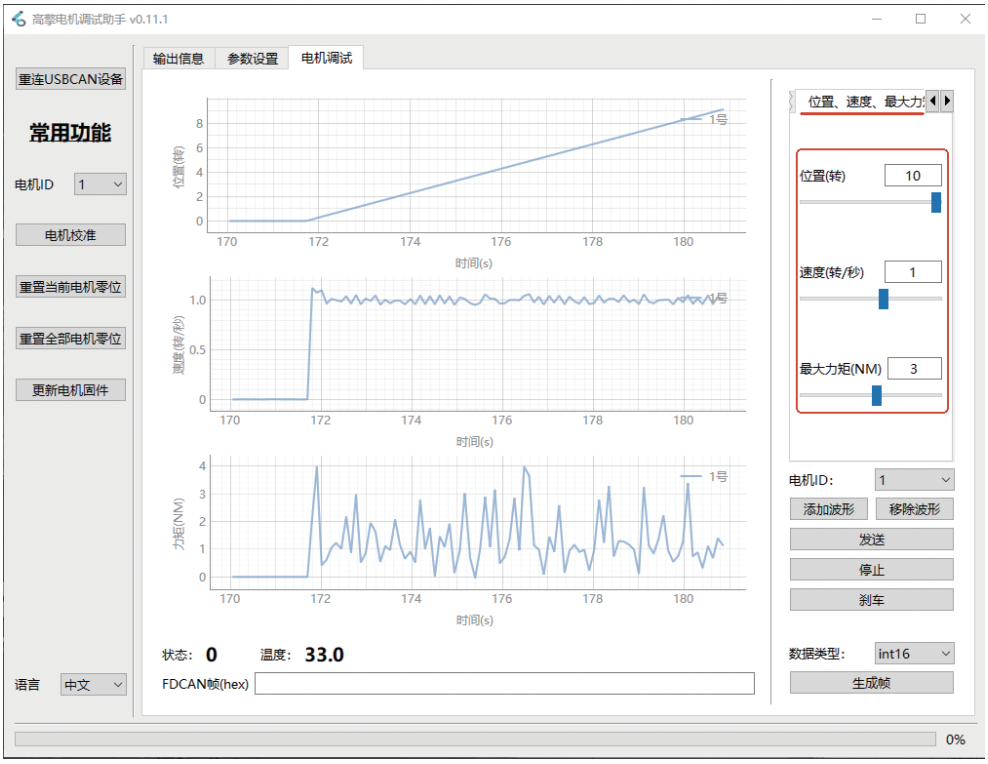
❺ Current mode

Set the Q phase current to send, given the specified Q phase current of the motor;



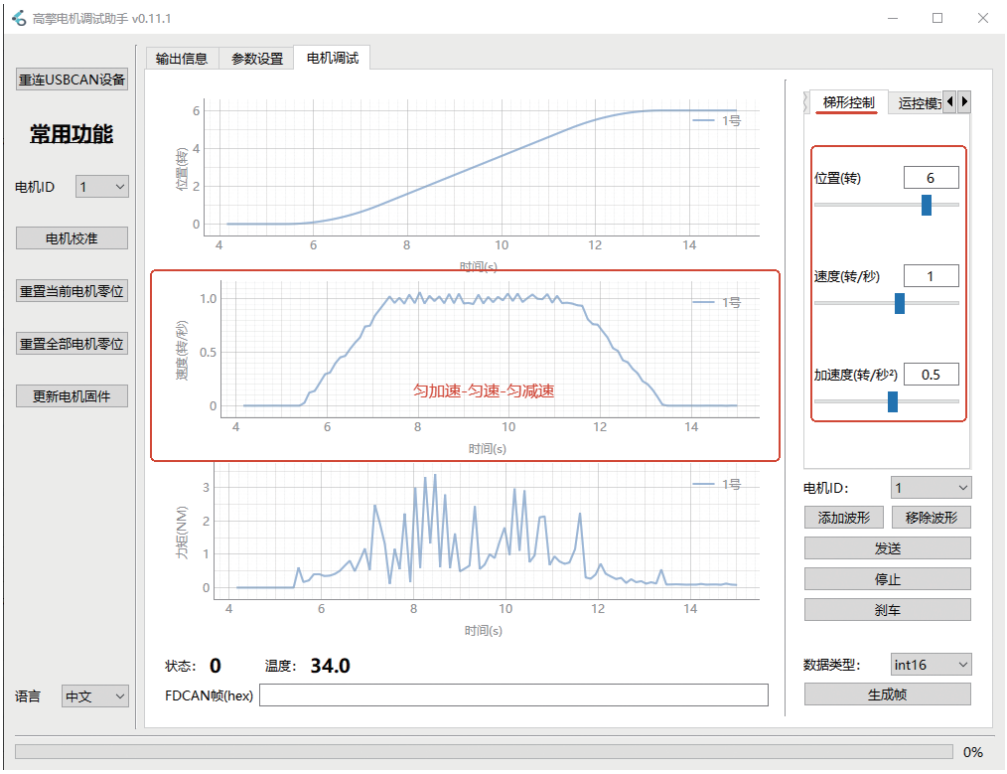
❻ Position, speed, maximum torque

The motor rotates to the specified position at the specified speed to stop, and limits the output torque, if you do not want to limit the torque, you can set the maximum torque to NAN;



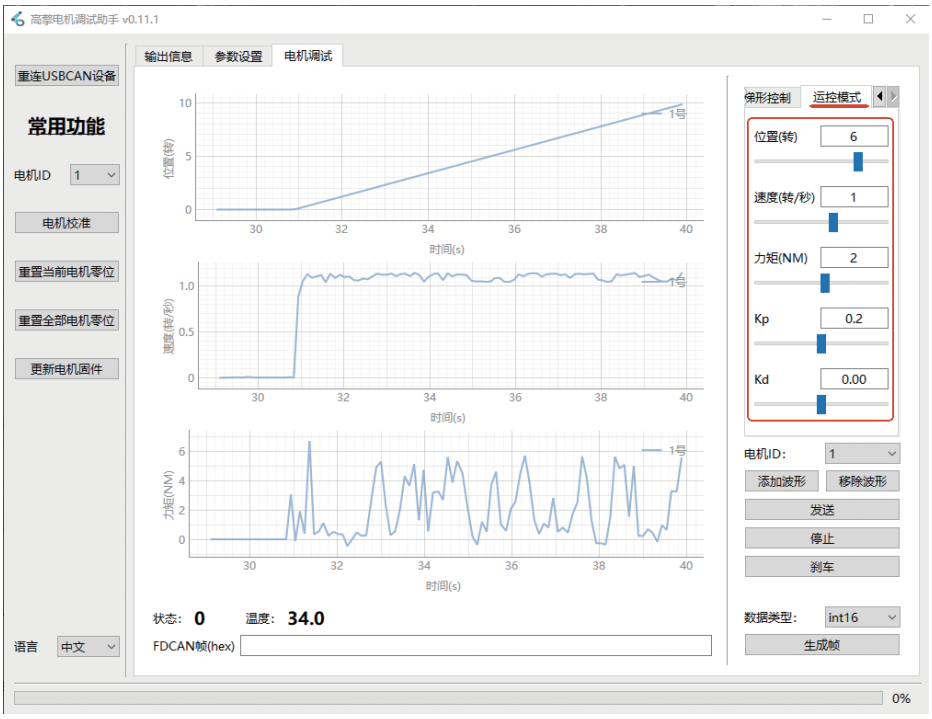
7 Trapezoidal control

Set the following three parameters for transmission, the motor will slowly turn to the specified speed with the given acceleration and then rotate at a constant speed. When approaching the target position, it will slowly decelerate until it stops at the target position.



8 Operation control mode

Motor output torque = position deviation * Kp + speed deviation * Kd + torque;



3. Generating frame example analysis

For a more detailed analysis, please refer to the documents "fdcan.pdf" in "Motor fdcan Protocol Analysis" and "Register Functions, Motor Operating Modes, Error Codes, and One-to-Many Mode Instructions.xlsx."

Analyzing using the int32 data frame speed mode as an example.:

01000a0a2000000080204e0000

❶ Subframe 1 The overall meaning is that the motor enters position mode.

0x01 The beginning of the first sub-frame

Tall four positions:

0000 ， Indicates a write operation.

Low four positions:

The higher 2 bits： 00 ， Represents int8_t type.
The lower 2 bits : 01, indicating 1 data.

0x00 Starting register address: According to the lookup table, register 0x00 indicates the motor mode settings.

(Table in Register Function, Error Codes, One-to-Many Mode Description . xlsx)

0x0a (Write 0x0a to register 0x00)

❷ Subframe 2 The overall meaning is that the position is not restricted, and the speed is 0.2 revolutions per second.

0x02 The beginning of the second sub-frame

Higher four-digit number:

0000, indicating a write operation.

Lower four-digit number:

The higher 2 bits are: 10, indicating int32_t type.
The lower 2 bits are: 10, indicating 2 data points.

0x20 Starting register address: According to the table, register 0x20 represents position, and register 0x21 represents speed.

0x00、0x00、0x00、0x80

Little-endian mode, that is, writing 0x80000000 to the 0x20 register, indicates that the motor position is unrestricted.

0x20、0x4e、0x00、0x00

In little-endian mode, writing 0x4E20 to register 0x21 indicates that the motor speed is set to 0.2 revolutions per second.

0x20、0x4e、0x00、0x00

In little-endian mode, writing 0x4E20 to register 0x21 indicates that the motor speed is set to 0.2 revolutions per second.

0x4e20 When converting to decimal, it is known from the table that when the int32 type value is 100000, the actual motor speed is 1 revolution per second, and 20000 corresponds to 0.2 revolutions per second. (The table is in section 2.7 of the document fdcan.pdf)

2.7 速度（转/秒）

数据类型	LSB	实际 (转/秒)
int8	1	0.01
int16	1	0.00025
int32	1	0.00001
float	1	1

Appendix

1、Error code explanation table

Error code	Name	explanation
32	Calibration failure	During the calibration process, the encoder cannot detect the magnet.
33	Motor drive failure	Mostly due to under-voltage, insufficient current.
34	Overpressure	The bus voltage is too high.
35	The encoder is malfunctioning.	Encoder reading error
36	The motor is not calibrated.	The motor has not been calibrated yet (the motor is calibrated once before leaving the factory).
37	PWM period exceeds the limit	It is generally an internal firmware error.
38	The temperature is too high.	Exceeded the maximum configuration temperature.
39	Exceed the limits	Try to start position control beyond the position limits (factory default has no position limits)
40	Voltage is too low	The voltage is lower than the motor operating voltage.
41	The configuration has been changed.	The configuration values that need to be stopped were changed during operation.
42	Angle is invalid	No available valid phase-shifting encoder.
42	Invalid location	No available valid output encoder